(2)

PERFORMANCE ORIENTED PACKAGING TESTING

OF

SIX-FOOT FLEXIBLE LINEAR SHAPED CHARGE BOX

FOR PACKING GROUP II HAZARDOUS MATERIALS

BY:

KERRY J. LIBBERT

MECHANICAL ENGINEER

Performing Activity:
Crane Division
Naval Surface Warfare Center
Crane, Indiana 47522-5000

OCTOBER 1992

FINAL

10pS

Sponsoring Organization:
Naval Weapons Station Earle
Program Management Office - Code 50
Colts Neck, New Jersey 07722-5000

Prepared by:

K. J. Libbert

Reviewed by:

R. F. Sanders

Reviewed by:

J. W. Puckett

Approved by:

D. N. Montgomery

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October, 1992	Final

4. TITLE AND SUBTITLE
Performance Oriented Packaging Testing of the Six-Foot Flexible Linear Shaped Charge Box for Packing Group II Hazardous Materials

5. FUNDING NUMBERS

6. AUTHOR(S)
Kerry J. Libbert

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Commander
Crane Division
Naval Surface Warfare Center
Code 4045
Crane, Indiana 47522

8. PERFORMING ORGANIZATION REPORT NUMBER
DODPOPHM/USA/DOD/NADTR92110

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander
Crane Division
Naval Surface Warfare Center
Code 4033
Crane, Indiana 47522

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unlimited Distribution

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The wood box (Drawing 53711-6665109) for six-foot flexible linear shaped charges was tested for conformance to Performance Oriented Packaging standards specified by the Code of Federal Regulations, Title 49 CFR, Parts 107 through 178, dated 31 December 1991. The box was tested with a gross weight of 14 kilograms and met all the requirements.

14. SUBJECT TERMS		15. NUMBER OF PAGES
Hazardous Materials	Wood Box	7
Performance Oriented Packaging		16. PRICE CODE
Flexible Linear Shaped Charge		

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to ***stay within the lines*** to meet ***optical scanning requirements***.

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	- Contract	**PR**	- Project
G	- Grant	**TA**	- Task
PE	- Program Element	**WU**	- Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in. When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

- **DOD** - See DoDD 5230.24, "Distribution Statements on Technical Documents."
- **DOE** - See authorities.
- **NASA** - See Handbook NHB 2200.2.
- **NTIS** - Leave blank.

Block 12b. Distribution Code.

- **DOD** - Leave blank.
- **DOE** - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
- **NASA** - Leave blank.
- **NTIS** - Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification at the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

INTRODUCTION

This Performance Oriented Packaging (POP) test was performed to ascertain whether the shipping and storage container for the Six-Foot Flexible Linear Shaped Charge meets the Packing Group II requirements specified by the Code of Federal Regulations, Title 49 CFR, Parts 107 through 178, dated 31 December 1991. The objectives were to evaluate the adequacy of the container in protecting the hazardous materials.

The container is a wood box with cavities cut into the bottom part to hold the charges. The open empty container is shown in Figure 1. Figure 2 shows the container closed and banded for shipment, as it was tested.

TESTS PERFORMED

1. Drop Test

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.603. One container was used for each drop orientation. The drop height was 1.2 meters and the drop sequence was as follows:

a. Flat on Bottom
b. Flat on Top
c. Flat on Long Side
d. Flat on Short Side
e. One Corner

The test was performed at ambient temperature (70^0 + 20^0F). The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.

2. Stacking Test

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.606. Three different containers were used, each with a stack weight of 3000 pounds. The test was performed for 24 hours. After the allowed time, the weight was removed and the container examined. Any leakage, deterioration, or distortion which could adversely affect transport or reduce its strength or cause instability in stacks of packages is cause for rejection.

3. Base Level Vibration Test

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.608. Three sample containers were loaded with steel rods to simulate the charges and closed as for shipment. Each container was placed on a vibrating platform that had a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform, but were free to move

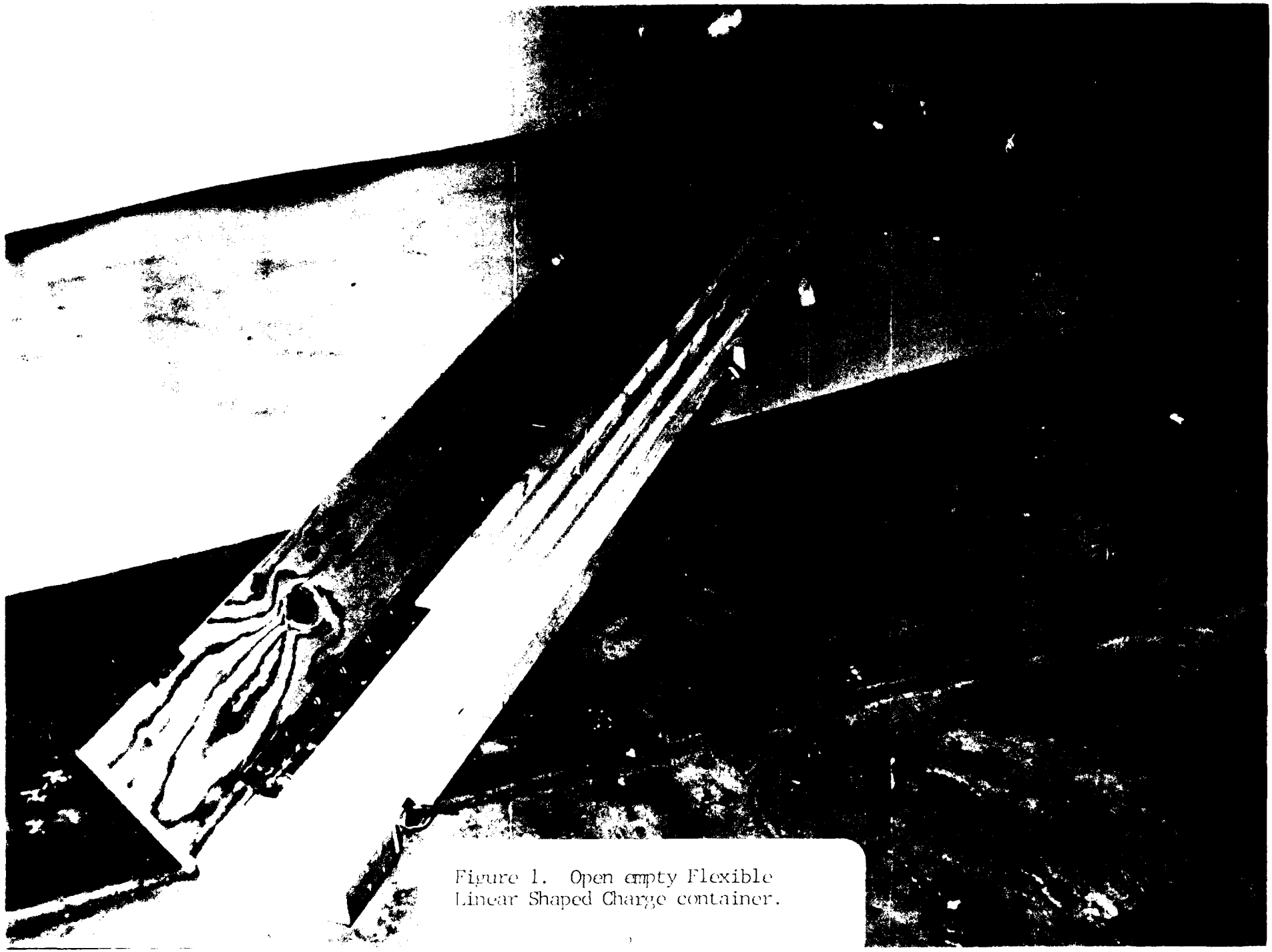

Figure 1. Open empty Flexible Linear Shaped Charge container.

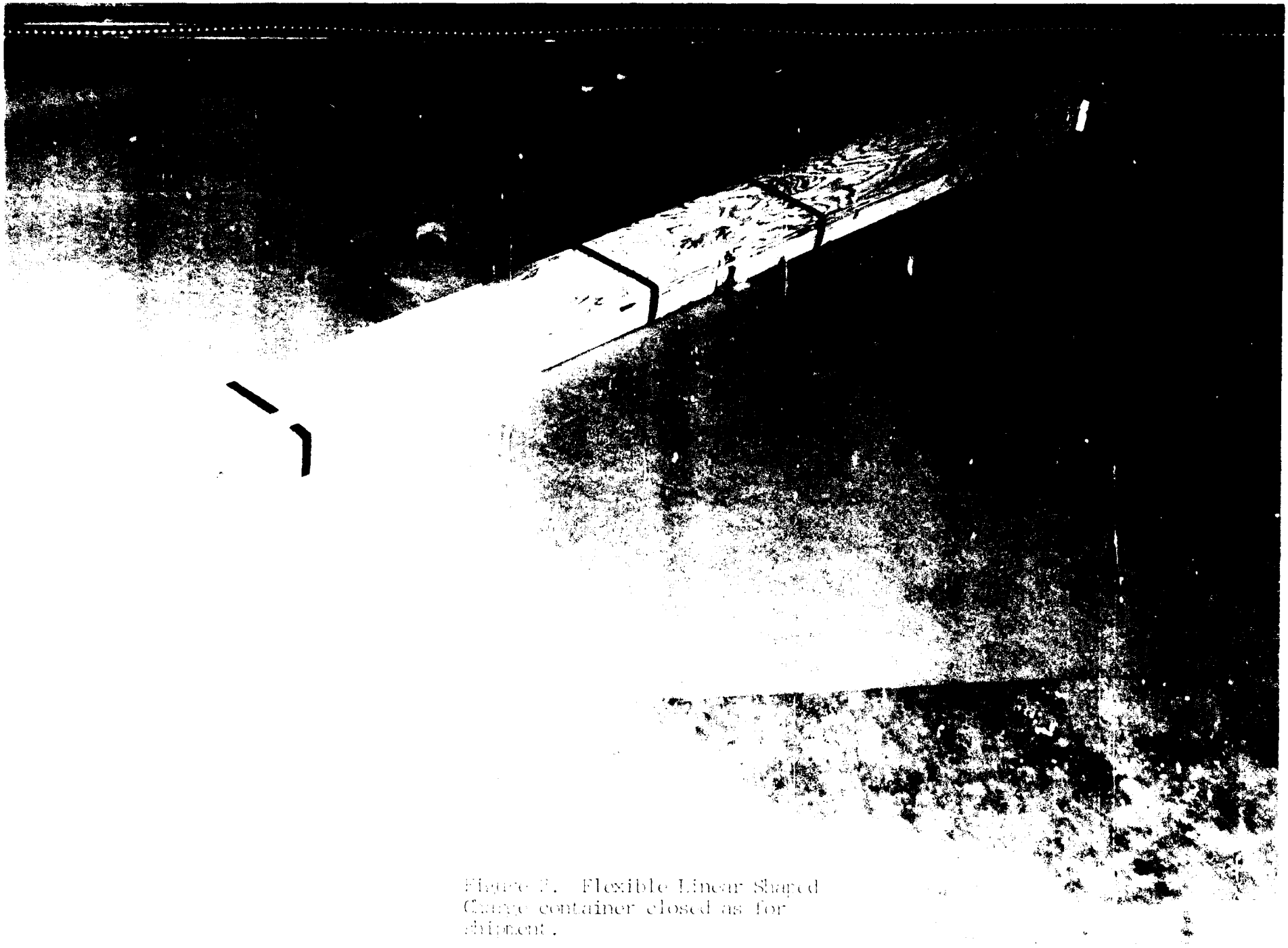

Figure 7. Flexible Linear Shaped Charge container closed as for shipment.

vertically, bounce and rotate. The test was performed for one hour at a frequency that caused each point of the container bottom to be raised from the platform 1.6 mm. A 1.6 mm thick metal strip was passed between the bottom of the container and the platform.

PASS/FAIL

1. Drop Test

The criteria for passing the drop test is outlined in Title 49 CFR, Part 178, Subpart M, Sec. 178.603(f): A package is considered to successfully pass the drop test if for each sample tested, no rupture occurs which would permit spillage of loose explosive substances or articles from the outer packaging.

2. Stacking Test

The criteria for passing the stacking test is outlined in Title 49 CFR, Part 178, Subpart M, Sec. 178.606: No test sample may show any deterioration which could adversely affect transportation safety or any distortion likely to reduce its strength, cause instability in stacks of packages, or cause damage to inner packagings likely to reduce safety in transportation.

3. Base Level Vibration Test

The criteria for passing the Base Level Vibration Test is outlined Title 49 CFR, Part 178, Subpart M, Sec. 178.608: Immediately following the period of vibration, each package must be removed from the platform, turned on its side and observed for any evidence of leakage. A packaging passes the vibration test if there is no rupture or leakage from any of the packages. No test sample should show any deterioration which could adversely affect transportation safety or any distortion liable to reduce packaging strength.

TEST RESULTS

1. Drop Test

Satisfactory.

2. Stacking Test

Satisfactory.

3. Base Level Vibration Test

Satisfactory.

DISCUSSION

1. Drop Test

After each drop the container was inspected for any damage which would be cause for rejection. Final inspection revealed some small cracks in the bottom parts of the containers at the ends, but the simulated charges were contained.

2. Stacking Test

Three containers were individually tested. Each container was visibly inspected after the 24-hour period was over. There was no leakage, distortion, or deterioration to the container as a result of this test.

3. Base Level Vibration Test

Immediately following the vibration test, each container was removed from the platform, turned on its side and observed for any evidence of leakage. All latches and bands remained fastened and there was no evidence of leakage of contents.

REFERENCE MATERIAL

Code of Federal Regulations Title 49 CFR, Parts 107-178.

DISTRIBUTION LIST

Commander
Crane Division
Naval Surface Warfare Center
Code 4045 and Code 4033
Crane, IN 47522-5000

Commanding Officer
Naval Weapons Station Earle
Code 50 and Code 50232
Colts Neck, NJ 07722-5000

Defense Technical Information Center (2 copies)
ATTN: DTIC/FDAC (Virginia Guidi)
Bldg. 5, Cameron Station
Alexandria, VA 22304-6145

Commander
U.S. Army Armament, Research, Development and Engineering Center
SMCAR-ESK
Rock Island, IL 61299-7300

Defense General Supply Center
DDRV-TMPA (Dave Gay)
Richmond, VA 23297-5000

DATA SHEET

CONTAINER:
Wood Container for the
Flexible Linear Shaped Charge

POP MARKING:
u
n
4C1/Y14/S/**
USA/DOD/NAD

Type: 4C1

UN Code: 1.1D

Specification Number:
None

Material:
Natural Wood

Capacity:
14 kg
(30.8 pounds)

Dimensions:
1.85m L x .14m W x .05m H
(72.88" L x 5.50" W x 2.06" H)

Closure (Method/type):
Latches (3 ea.)
1/4" steel banding (4 ea.)

Tare Weight:
6.04 kg
(13.3 pounds)

Additional Description: Box was constructed in accordance with Drawing 53711-6665109.

PRODUCTS:
Linear Flexible Shaped Charge, see Table I

Proper Shipping Name: Charges, Shaped, Flexible, Linear

United Nations Number: 0288

United Nations Packing Group: N/A

Physical State: Solid

Amount Per Container: See Table I

Gross Weight: See Table I

TEST PRODUCT:
Name: Steel rods
Physical State: Solid

Size : 1.83m L x .01m Dia
(72"L x .50"Dia)

Quantity : 3

Dunnage: Foam polyethylene, PPP-C-1752
Gross Weight: 14 kg (30.8 lbs.)

TABLE I

DODIC OR NALC	NSN	ITEM (FLSC GR/FT)	PACKING DRAWING	#/CNTR	GROSS WT (KG)
MM41	1375-01-318-8571	30	6665108	6	7.41
MM42	1375-01-318-9821	40	6665108	6	7.66
MM43	1375-01-319-0940	60	6665108	6	8.06
MM44	1375-01-318-9822	75	6665108	6	8.71
MM45	1375-01-319-0941	125	6665108	6	9.06
MM46	1375-01-318-0754	225	6665108	3	9.93
MM47	1375-01-318-0753	400	6665108	3	10.46
MM48	1375-01-319-9184	600	6665108	3	11.78